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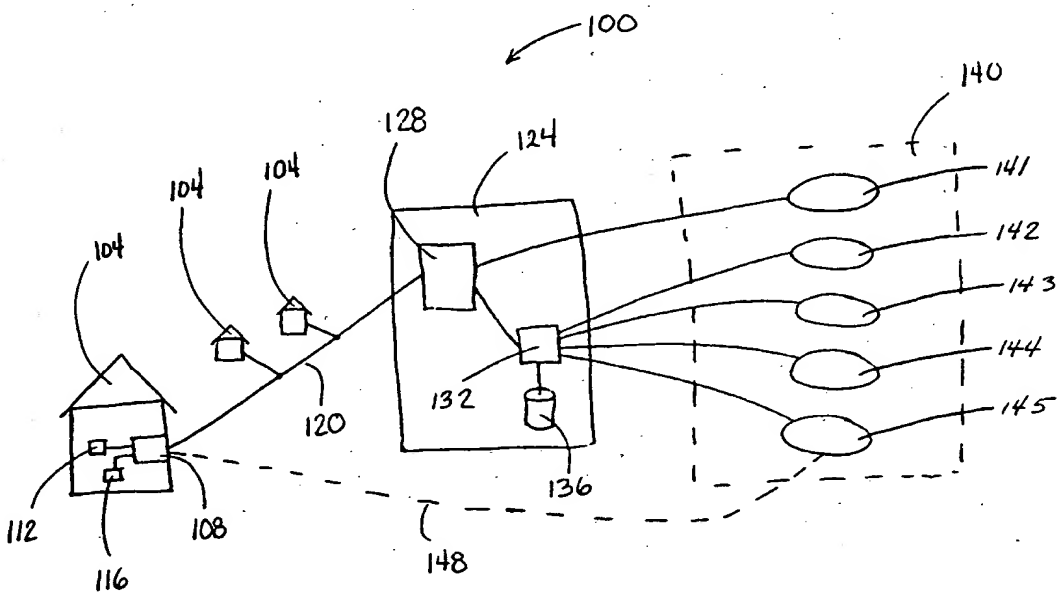

(57) Abstract

A system and method for providing telephony and high speed data access on a broadband access network, comprising a network interface unit (NIU) coupled to a backup local exchange carrier (LEC) line, the broadband access network coupled to the NIU, an intermediate point–of–presence (IPOP) coupled to the broadband access network, and at least one external access network coupled to the IPOP. The NIU comprises a broadband telephone interface (BTI) which is coupled to at least one telephone. When the broadband access network is unavailable, the BTI switches the at least one telephone to the backup LEC line.

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A METHOD AND SYSTEM FOR TELEPHONY AND HIGH SPEED DATA ACCESS ON A BROADBAND ACCESS NETWORK

Priority Claim

We hereby claim the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Application No. 60/073,251 filed January 30, 1998, entitled "Telephony Over Broadband Access Networks."

Related Patent Application

This patent application is related, in part, to the subject matter contained in a U.S. patent application entitled "A Method And System for Telephony and High Speed Data Access on a Broadband Access Network" filed on January 14, 1999.

Field of the Invention

This invention relates to the field of broadband access networks, and more specifically to a method and system for telephony and high speed data access on a broadband access network.

Background of the Invention

Broadband access networks may provide a viable alternative to present local exchange carrier (LEC) loops in providing voice and data transmissions. Although a number of innovations have occurred concerning high speed cable modems and radio frequency (RF) telephony equipment, these innovations do not support both high speed data and telephony well. Furthermore, present broadband access networks such as cable systems are susceptible to network failures and power outages. During, for example, a power outage, transmission over the cable system is not possible. LEC loops have very limited bandwidths; however, the LEC loops have separate power sources and operate even during power outages providing for emergency calls or other lifeline services.

What is needed is an invention that supports high speed data and telephony access over broadband access networks while still providing, at least, basic telephony service during power outages.

Summary of the Invention

The present invention provides for a broadband telephone interface (BTI) for use in a system for telephony and high speed data access on a cable network. The BTI includes a

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first interface coupled to a backup telephone service, a second interface coupled to at least one telephone, a third interface coupled to a cable modem, the cable modem being coupled to the cable network, and a relay. During availability of the cable network, the second interface is coupled to the third interface. During unavailability of the cable network, the relay couples the first interface to the second interface.

The present invention also provides for a network interface unit (NIU) for a system for telephony and high speed data access on a broadband access network. The NIU includes a cable modem and a broadband telephone interface (BTI) coupled to the cable modem, the BTI providing access to lifeline services when the broadband access network is not accessible.

The present invention provides for a process for making a system for telephony and high speed data access on a broadband access network. The process includes the steps of coupling at least one telephone with a broadband telephone interface (BTI), coupling a backup telephone connection with the BTI, coupling the BTI with a cable modem, coupling the cable modem with the broadband access network, coupling the cable modem with at least one computer.

The present invention also provides for a method for making telephone calls in a system for telephony and high speed data access on a broadband access network when the broadband access network is inaccessible. The method includes the step of automatically coupling a telephone interface of a broadband telephone interface (BTI) to a backup telephone connection. In some preferred embodiments, the step of automatically coupling includes the step of automatically coupling the telephone interface of the BTI to a local exchange carrier (LEC) line. In other preferred embodiments, the step of automatically coupling includes the step of automatically coupling the telephone interface of the BTI to a wireless communication system. In yet other preferred embodiments, the step of automatically coupling includes the step of automatically coupling the telephone interface of the BTI to a cellular phone system.

The present invention provides for a method of making a telephone call by a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network. The method includes the steps of initiating a connection

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over an asynchronous transfer mode (ATM) backbone to a destination address, negotiating with the destination address with regard to capabilities, and completing a talking path between the BTI and the destination address.

The present invention provides for a method of sending a voice signal through a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network. The method includes the steps of sampling the voice signal at a telephone port of the BTI, performing speech compression on the sampled signal, performing packetization on the speech compressed signal, and placing the signal packets on the broadband access network.

The present invention also provides for a method of receiving a voice signal by a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network. The method includes the steps of receiving packets from the broadband access network, performing jitter compensation on the received packets, performing decompression on the jitter compensated packets, and playing the decompressed packets.

Brief Description of the Drawings

Figure 1 illustrates a system which provides telephony and high speed data access on a broadband access network.

Figure 2 illustrates an office in a system which provides telephony and high speed data access on a cable system.

Figure 3 illustrates a preferred embodiment with an internal relay.

Figure 4 illustrates another preferred embodiment with an external relay.

Detailed Description

Figure 1 illustrates a system which provides telephony and high speed data access on a broadband access network in accordance with a preferred embodiment of the present invention. The system 100 comprises offices 104, network interface units (NIUs) 108, personal computers 112, telephones 116, a broadband access network 120, an intermediate point-of-presence (IPOP) 124, an access network termination system (ANTS) 128, a switch 132, at least one number translation database 136, at least one external access network 140 and a local exchange carrier (LEC) line 148.

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Each office 104 comprises the NIU 108, the personal computer 112 and the telephone 116. The personal computer 112 is coupled to the NIU 108, the coupling being preferably through a local area network (LAN) such as, for example, an ethernet. As such, there may be a plurality of personal computers 112 coupled to the NIU 108. The telephone 116 is also coupled to the NIU 108. There may be more than one telephone 116 within the office 104 coupled to the NIU 108 either directly or indirectly. Furthermore, the telephone 116 may include any variety of office equipment such as fax machines, voice-grade modems, hand sets and internal housing wiring.

Each office 104 is coupled to the broadband access network 120 through its NIU 108. The broadband access network 120 is coupled to the IPOP 124. The broadband access network 120 in the system 100 is intended to accommodate a range of transport technologies such as, but not limited to, coaxial cable, hybrid-fiber coaxial cable, mini-fiber node and wireless technologies.

The IPOP 124 comprises the ANTS 128, the switch 132 and the at least one number translation database 136. The ANTS 128 is coupled to the switch 132 which, in turn, is coupled to the at least one number translation database 136. The ANTS 128 is coupled to the broadband access network 120. In a preferred embodiment, the at least one external access network 140 is coupled either to the ANTS 128 and/or to the switch 132. In a preferred embodiment, the at least one external access network 140 comprises a packet backbone 141 coupled to the ANTS 128. In another preferred embodiment, the at least one external access network 140 comprises an asynchronous transfer mode (ATM) backbone (not shown) coupled to the ANTS 128. In another preferred embodiment, the at least one external access network 140 comprises a long distance carrier network 142 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an LEC network 145 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an incumbent local exchange carrier (ILEC) network 144 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an inter-exchange carrier (IXC) network 143 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises the ATM backbone

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(not shown) coupled to the switch 132. The present invention contemplates any permutations and combinations of the above possible external access networks 140 and possible couplings to the IPOP 124.

In a preferred embodiment, the LEC line 148 couples the NIU 108 with the LEC network 145.

The general use and operation of the system 100 will now be described with reference to Figure 1. A user accesses the broadband access network 120 by using existing personal computers 112 or telephones 116 in the office 104. The voice and/or high speed data traffic transferred or received by these devices 112 and 116 passes through the NIU 108. The NIU 108 terminates the data-link layer protocol from the broadband access network 120 and provides services for voice, high speed data and any combination thereof. High speed data and telephony services share allocated bandwidth in the downstream direction as well as in the frequency agile upstream channel.

A remote data-link layer termination is performed at the IPOP 124 by the ANTS 128. Voice and high speed data traffic flowing to and from the offices 104 pass through the ANTS 128. Upstream voice and high speed data traffic are separated or groomed by the ANTS 128, if necessary, before being forwarded onwards. In a preferred embodiment, upstream voice traffic may be processed within the ANTS 128 which connects the voice to a circuit switched public switched telephone network (PSTN). Upstream data may be processed within the ANTS 128 before being handed to a router. In another preferred embodiment, upstream voice traffic is separated and routed to, for example, the packet backbone 141. Voice traffic is separated and routed to, for example, the local exchange switch 132. In another preferred embodiment, the ANTS 128 interfaces to the local switch 132 like, for example, a conventional subscriber loop carrier (SLC) system.

The system 100 acts, in part, as an LEC, providing voice service over the broadband access network 120. Calls originating from office 104 may be routed to, for example, the long distance network 142, the IXC network 143, the ILEC network 144 or the LEC network 145. Incoming long distance calls are routed to, for example, the LEC that serves the local number using the local number portability database. Several number translation databases 136 are typically needed in order to manage call routing.

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If communication to the IPOP 124 over the broadband access network 120 is not possible, lifeline services are provided, for example, through an LEC line 148 connected to the NIU 108. Thus, emergency phone calls can be made through the NIU 108 and the LEC line 148. If necessary, in one preferred embodiment, a call forwarding function in the local exchange switch 132 forwards telephone calls through the LEC line 148 to the telephone 116.

Figure 2 illustrates an office in a system which provides telephony and high speed data access on a cable system in accordance with another preferred embodiment of the present invention. The office 104 houses the NIU 108, the personal computer 112, the telephone 116, a local area network (LAN) 212 and a television 216. The NIU 108 further comprises a broadband telephone interface (BTI) 204 coupled to a cable modem 208. The BTI 204 may be integrated into the cable modem 208, a digital set-top box (not shown), or may be a standalone. For example, the BTI 204 may be a daughter card attached to a backplane bus within the cable modem 208 or set-top box.

The office 104 is coupled to the LEC line 148 and the broadband access network 120, which is illustrated in this preferred embodiment as a cable network. The LEC line 148 is coupled to the BTI 204 which is coupled to the telephone 116. The telephone 116 may comprise a plurality of telephones in an internal telephone network and may further include legacy equipment such as, but not limited to, fax machines, voice-grade modems, hand sets and internal housing wiring. The BTI 204 may have a plurality of telephony interfaces such as, for example, standard RJ-11 jacks to support a plurality of lines of telephony service. Accordingly, the BTI 204 may support a plurality of telephone numbers and addresses. The BTI 204 is expected to provide at least substantially the same interface as existing user interfaces to the PSTN.

The cable network 120 is coupled to the cable modem 208 or alternatively, the digital set-top box. The cable modem 208 is coupled to the LAN 212 which is coupled to the personal computer 112. The LAN 212 may be an ethernet, for example, and the personal computer 112 may be a plurality of personal computers coupled to the ethernet. The cable modem 208 is coupled to the LAN 212 through a data interface such as, for example, a 10 Mbs ethernet interface. Such an interface may be viewed as a termination in

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an office-area local network, with the cable modem 208 acting, in part, as a bridge. The cable 120 may also be coupled directly to the television 216 or may be coupled to the television 216 through a cable modem or digital set-top box.

In operation and use, the personal computers 112 through the ethernet 212 access high speed data ports in the cable modem 208. Through the cable modem 208, the ethernet 212 accesses, for example, internet services on the cable network 120. The television 216 accesses voice, high speed data and combinations thereof directly from the cable network 120, or alternatively from the cable modem 208 or the digital set-top box.

In a preferred embodiment, the BTI 204 supports a plurality of functions and services. The BTI 204 may provide, for example, at least one of the following: voice packetization, voice compression, the signaling and controlling of telephone calls, custom and basic service features, switching to backup service when the cable network 120 is down, and maintenance and provisioning.

For example, in a preferred embodiment, the BTI 204 provides custom telephony services including, but not limited to, caller identification, call waiting, tone block, return call, repeat call, call block, call forwarding, call forwarding on busy, call forwarding when no answer, anonymous call rejection, identa-ring, priority call, three-way calling and area code blocking. Furthermore, through the BTI 204, a wide ranging list of destinations may be dialed including, but not limited to, local calls, directory assistance, emergency calls, recorded announcements, domestic long distance calls, carrier-selected long distance calls, toll-free calls, operator services, international calls, so-called 500/700/900 calls, and Centrex dialing. In addition, the BTI 204 supports incoming calls over the cable network 120.

For the telephone ports, in the upstream direction, the BTI 204 samples the signal, performs speech compression, and performs packetization. The cable modem 208 places the packets on the cable network 120. In the downstream direction, the BTI 204 receives packets from the cable network 120 through the cable modem 208, performs jitter compensation in a playout buffer, performs decompression and plays out the samples.

In a preferred embodiment, the BTI 204 is used with existing cable modems 208, or alternatively, existing set-top boxes. The BTI 204 is also responsible for dual tone

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multi-frequency (DTMF) generation and detection, ringing voltage generation and off-hook detection. The standard RJ-11 jacks of the BTI 204 provide interfaces to legacy equipment in the office, such as, but not limited to, telephones including analog devices, fax machines and voice-band modems with speeds up to at least 56 kbps.

The aforementioned architecture and approach offer compelling economic advantages. By leveraging cable modem solutions for high-speed data access into the realm of telephony, equipment such as cable modems 208 or set-top boxes facilitate multiple services. Accordingly, channels dedicated previously only to data service may also derive revenue from telephony. Furthermore, in order for cable telephone to be used as a primary local telephone service, the present invention must support lifeline services even when the cable network 120 is down.

The BTI 204 supports a dynamic fail-safe switch to, for example, the LEC backup line 148. Transmission on the cable network 120 requires power. Therefore, absent a backup power source for the cable network, e.g., an alternatively powered cable system, which is also contemplated by the present invention, an alternative to the cable network is required. In a preferred embodiment, during power outages, the LEC line 148 is used to complete inbound and outbound telephone calls. The transition from the cable network 120 to the LEC line 148 is performed automatically and transparently with almost imperceptible performance differences. In some preferred embodiments, calls in progress at the time of a power loss are dropped, and the user must redial. In other preferred embodiments, custom calling features are not available during power outages. In another preferred embodiment, the BTI 204 provides, for example, all PSTN features and functions, except during the fail-safe mode. In the fail-safe mode of another preferred embodiment, the LEC backup line 148, for example, provides basic plain old telephone service (POTS).

Figures 3 and 4 illustrate two embodiments of the present invention that also support lifeline services. In Figures 3 and 4, much of the structure has been previously described above; in addition, a relay 304 or 308 is coupled to the BTI 204. Figure 3 illustrates one embodiment including the internal relay 304 which may be integrated with the BTI 204. Figure 4 illustrates another embodiment including the external relay 308. In

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either embodiment, the relay 304 or 308 is managed by the BTI 204. The relay 304 or 308 switches or bridges one or more of the telephones 116, interfaced with the BTI 204, to the LEC backup line 148 when, for example, a power outage has occurred or the cable network 120 is unavailable. In another preferred embodiment, the BTI 204 supports lifeline services by switching to a backup cellular phone service (not shown) instead of the LEC line 148.

In one preferred embodiment, the relay 304 or 308 is, for example, a double-pole, double-throw spring-loaded relay. Normally-closed contacts are coupled to the LEC backup line 148; normally-opened contacts are coupled to the BTI 204; center contacts are coupled to tip and ring signals of the telephone 116. In another preferred embodiment, the backup cellular phone service is adapted to couple with the double-pole, double-throw spring-loaded relay.

In a preferred embodiment, the BTI 204 provides non-volatile storage, for example, EEPROM, so as to allow the maintenance of some amount of state at the BTI 204. Such an architecture and approach facilitate the migration of many telephony features into the BTI 204. With the further installation of intelligence such as, for example, processing and memory into the BTI 204, unique opportunities arise pertaining to reinventing network operations with a very high level of automation, a corresponding reduction in operating costs and a significant increase in overall service quality. Such architectures and approaches accommodate future networks by, for example, providing compatibility with the ATM backbone as well as adaptability to any new features and functions that may arise. In a preferred embodiment, for example, with the migration of feature support into the BTI 204, ATM telephony is routed directly to an edge vehicle on a backbone network; internet protocol (IP) telephony along with other data traffic is sent to a router/switch edge vehicle on the backbone network or is directly routed onto the internet.

In a preferred embodiment, the BTI 204, with special feature support, accesses the ATM backbone network directly. The BTI 204 performs digit collection, as well as many call handling features as described above including, but not limited to, call waiting, call forwarding and last number redial. The BTI 204 initiates a connection over the ATM backbone to the destination address, negotiates with that endpoint regarding capabilities

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such as, but not limited to, coding, encapsulation, silence suppression, and finally completes the talking path. The BTI 204 uses the quality of service features of the ATM network to provide toll-quality telephony.

In a preferred embodiment, the BTI 204 may have certain requirements in order to provide voice quality that is as close to wireline voice quality as possible. For example, in order to minimize echo, the BTI 204 should provide echo cancellation of a minimum of 70 dB. In another preferred embodiment, the access delay, the round-trip time measured from a mouthpiece of a hand set of the telephone 116 to the access point of a long distance network and back, should be less than 20 ms. In another preferred embodiment, the BTI 204 may support silence suppression and speech enhancement. In another preferred embodiment, an 8kHz national clock which controls the sampling frequency and regeneration frequency should be used by the BTI 204 to encode speech signals.

In a preferred embodiment, in order to support legacy voiceband data equipment, such as, but not limited to, fax machines and telephone bandwidth modems, the BTI 204 should support 64 kb/s G.711 mu-law PCM as one choice of coders. In another preferred embodiment, the BTI 204 may also support G.728 or G.723.1 as choices of coders. In another preferred embodiment, since echo cancellation tends to cause troubles for the above mentioned legacy equipment, the BTI 204 should be able to recognize a fax or modem control tone and disable echo cancellation during these calls.

In a preferred embodiment in which voice connections are transported over an ATM fabric, the BTI 204 should be capable of sending packets that will be transferred to the ATM fabric as signaling packets. In another preferred embodiment, the BTI 204 should be able to transport packets destined to ATM interface as either available-bit-rate (ABR) or constant-bit-rate (CBR) connections. In another preferred embodiment, the BTI 204 should be able to identify packets destined for the IP router or the SLC and connect as either ABR or CBR connections.

Although the foregoing invention has been described in terms of certain embodiments, other embodiments will become apparent to those of ordinary skill in the art in view of the disclosure herein. Accordingly, the present invention is not intended to be

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limited by the recitation of embodiments, but is intended to be defined solely by reference to the appended claims.

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WHAT IS CLAIMED IS:

1. A broadband telephone interface (BTI) for use in a system for telephony and high speed data access on a cable network, comprising:

a first interface coupled to a backup telephone service;

a second interface coupled to at least one telephone;

a third interface coupled to a cable modem, the cable modem being coupled to the cable network; and

a relay, wherein during availability of the cable network the second interface is coupled to the third interface and wherein during unavailability of the cable network, the relay couples the first interface to the second interface.

2. The broadband telephone interface (BTI) of Claim 1, wherein the backup telephone service is a backup local exchange carrier (LEC) line.

3. The broadband telephone interface (BTI) of Claim 1, wherein the backup telephone service is a cellular phone service.

4. The broadband telephone interface (BTI) of Claim 1, wherein the second interface is at least one standard RJ-11 jack.

5. The broadband telephone interface (BTI) of Claim 1, wherein the at least one telephone comprises any of fax machines, modems, internal housing wiring, hand sets, analog telephones and digital telephones.

6. The broadband telephone interface (BTI) of Claim 1, wherein the BTI and the cable modem are integrated.

7. The broadband telephone interface (BTI) of Claim 1, wherein the cable modem includes a set-top box.

8. The broadband telephone interface (BTI) of Claim 1, further comprising:

non-volatile storage;

a processor coupled to the non-volatile storage; and

a memory coupled to the processor, wherein the interfaces and the relay are controlled by the processor.

9. A network interface unit (NIU) for a system for telephony and high speed data access on a broadband access network, comprising:

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a cable modem; and

a broadband telephone interface (BTI) coupled to the cable modem, the BTI providing access to a telephone line when the broadband access network is not accessible.

10. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) provides any of the services from the group consisting of voice packetization, signaling and controlling of telephone calls, custom and basic service features, and maintenance and provisioning.

11. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) provides any custom service selected from the group consisting of caller identification, call waiting, tone block, return call, repeat call, call block, call forwarding, call forwarding on busy, call forwarding when no answer, anonymous call rejection, identa-ring, priority call, three-way calling, and area code blocking.

12. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) provides through the cable modem a calling destination selected from the group consisting of local calls, directory assistance, emergency calls, recorded announcements, domestic long distance calls, carrier-selected long distance calls, toll-free calls, operator services, international calls, 500/700/900 calls, and Centrex dialing.

13. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) supports incoming calls over the cable modem.

14. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) provides any of dual tone multi-frequency (DTMF) generation and detection, ringing voltage generation and off-hook detection.

15. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) accesses an asynchronous transfer mode (ATM) backbone network directly.

16. A process for making a system for telephony and high speed data access on a broadband access network, comprising the steps of:

coupling at least one telephone with a broadband telephone interface (BTI);

coupling a backup telephone connection with the BTI;

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coupling the BTI with a cable modem;

coupling the cable modem with the broadband access network; and

coupling the cable modem with at least one computer.

17. A method for making telephone calls in a system for telephony and high speed data access on a broadband access network when the broadband access network is inaccessible, comprising the step of automatically coupling a telephone interface of a broadband telephone interface (BTI) to a backup telephone connection.

18. The method of Claim 17, wherein the step of automatically coupling comprises the step of automatically coupling the telephone interface of the BTI to a local exchange carrier (LEC) line.

19. The method of Claim 17, wherein the step of automatically coupling comprises the step of automatically coupling the telephone interface of the BTI to a wireless communication system.

20. The method of Claim 17, wherein the step of automatically coupling comprises the step of automatically coupling the telephone interface of the BTI to a cellular phone system.

21. A method of making a telephone call by a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network, comprising the steps of:

initiating a connection over an asynchronous transfer mode (ATM) backbone to a destination address;

negotiating with the destination address with regard to capabilities; and

completing a talking path between the BTI and the destination address.

22. A method of sending a voice signal through a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network, comprising the steps of:

sampling the voice signal at a telephone port of the BTI;

performing speech compression on the sampled signal;

performing packetization on the speech compressed signal; and

placing the signal packets on the broadband access network.

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23. A method of receiving a voice signal by a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network, comprising the steps of:

receiving packets from the broadband access network;

performing jitter compensation on the received packets;

performing decompression on the jitter compensated packets; and

playing the decompressed packets.

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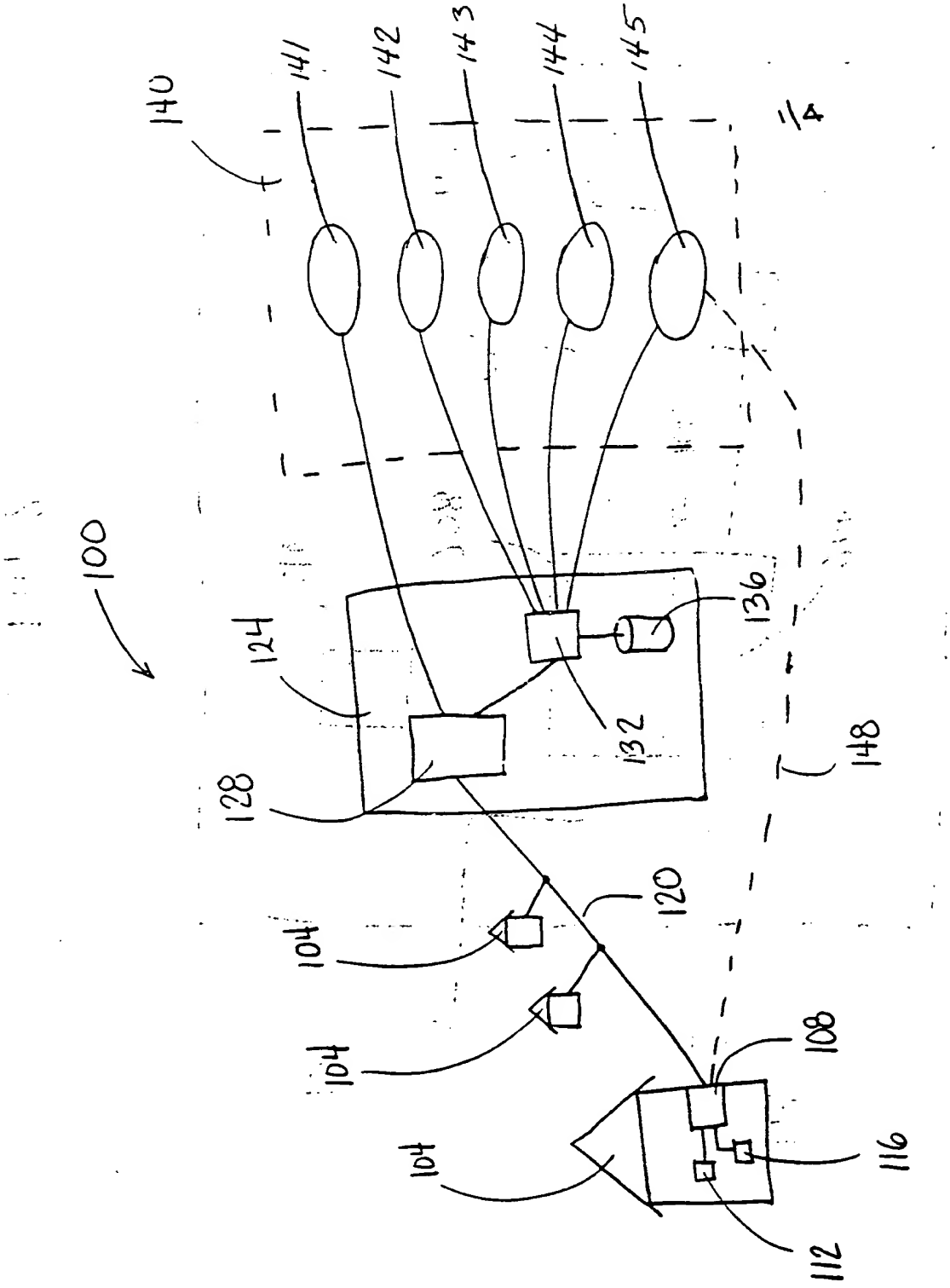

FIG. 1

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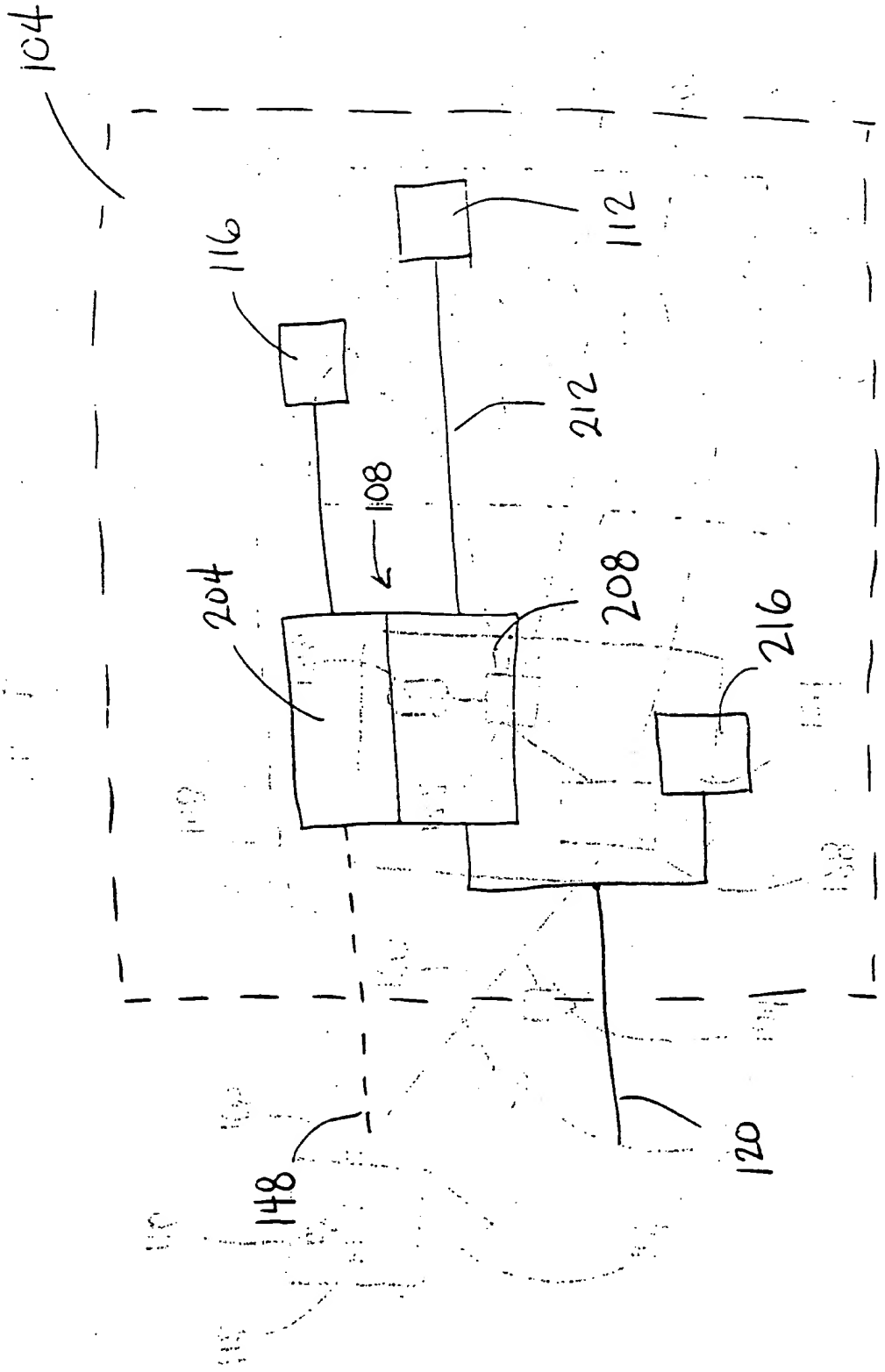

FIG. 2

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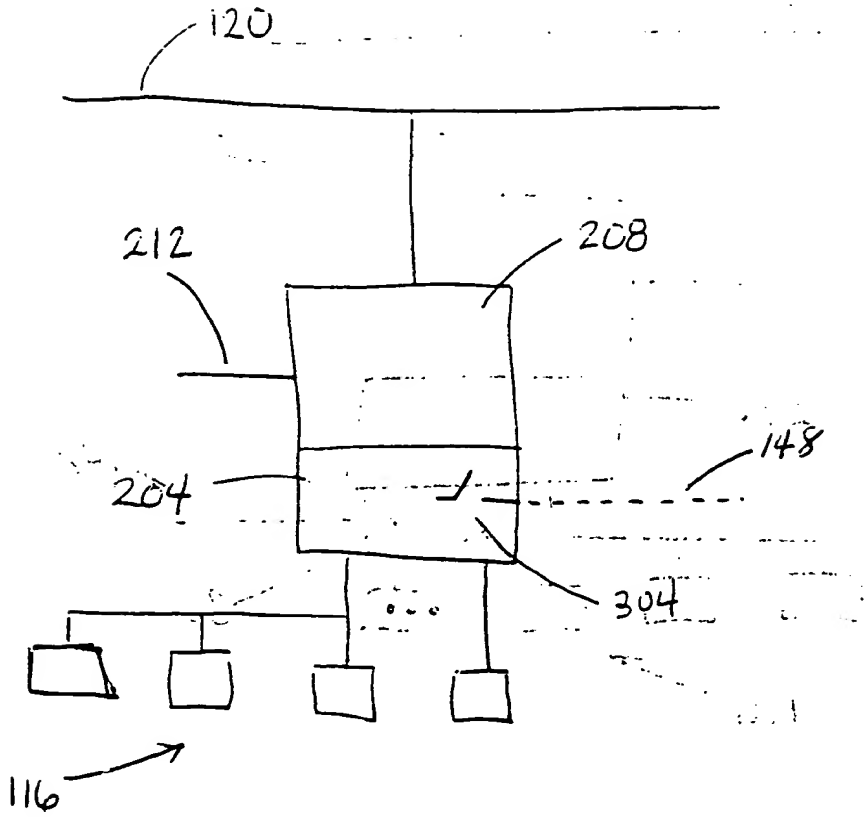

FIG. 3

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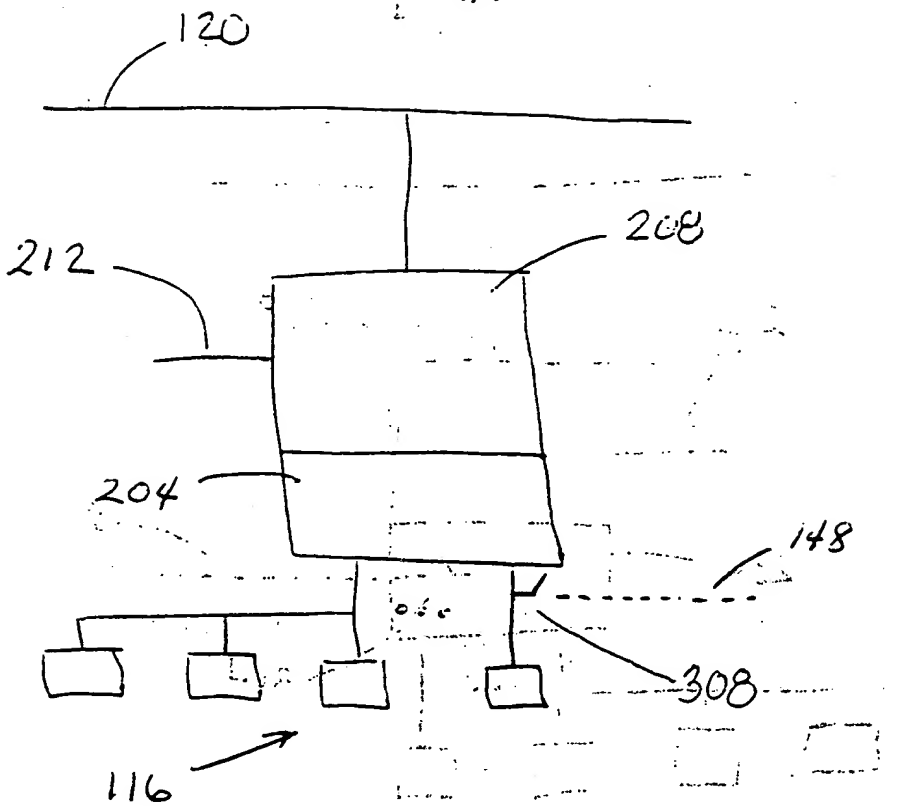

FIG. 4.

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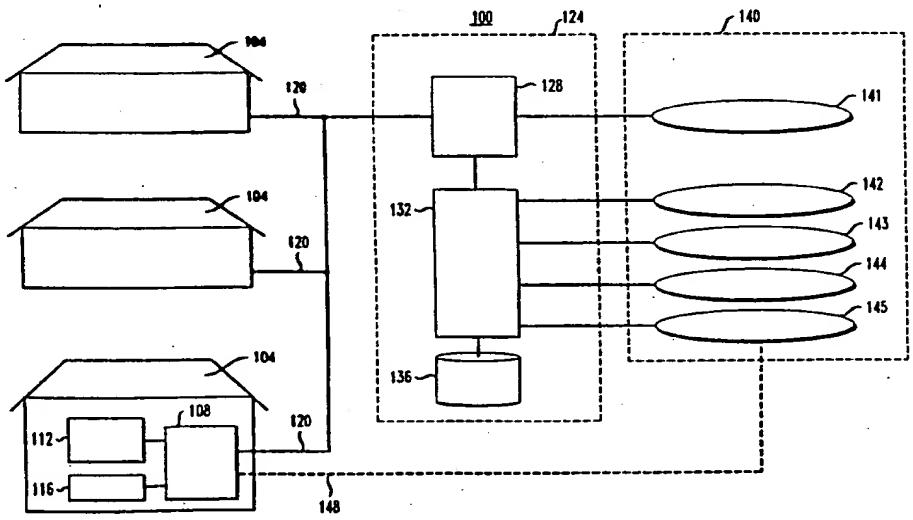

(57) Abstract

A system and method for providing telephony and high speed data access on a broadband access network, comprising a network interface unit (NIU) coupled to a backup local exchange carrier (LEC) line, the broadband access network coupled to the NIU, an intermediate point-of-presence (IPOP) coupled to the broadband access network, and at least one external access network coupled to the IPOP. The NIU comprises a broadband telephone interface (BTI) which is coupled to at least one telephone. When the broadband access network is unavailable, the BTI switches the at least one telephone to the backup LEC line.

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A METHOD AND SYSTEM FOR TELEPHONY AND HIGH SPEED DATA ACCESS ON A BROADBAND ACCESS NETWORK

Priority Claim

We hereby claim the benefit under 35 U.S.C. § 119(e) of U.S. Provisional Application No. 60/073,251 filed January 30, 1998, entitled "Telephony Over Broadband Access Networks."

Related Patent Application

This patent application is related, in part, to the subject matter contained in a U.S. patent application entitled "A Method And System for Telephony and High Speed Data Access on a Broadband Access Network" filed on January 14, 1999.

Field of the Invention

This invention relates to the field of broadband access networks, and more specifically to a method and system for telephony and high speed data access on a broadband access network.

Background of the Invention

Broadband access networks may provide a viable alternative to present local exchange carrier (LEC) loops in providing voice and data transmissions. Although a number of innovations have occurred concerning high speed cable modems and radio frequency (RF) telephony equipment, these innovations do not support both high speed data and telephony well. Furthermore, present broadband access networks such as cable systems are susceptible to network failures and power outages. During, for example, a power outage, transmission over the cable system is not possible. LEC loops have very limited bandwidths; however, the LEC loops have separate power sources and operate even during power outages providing for emergency calls or other lifeline services.

What is needed is an invention that supports high speed data and telephony access over broadband access networks while still providing, at least, basic telephony service during power outages.

Summary of the Invention

The present invention provides for a broadband telephone interface (BTI) for use in a system for telephony and high speed data access on a cable network. The BTI includes a

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first interface coupled to a backup telephone service, a second interface coupled to at least one telephone, a third interface coupled to a cable modem, the cable modem being coupled to the cable network, and a relay. During availability of the cable network, the second interface is coupled to the third interface. During unavailability of the cable network, the relay couples the first interface to the second interface.

The present invention also provides for a network interface unit (NIU) for a system for telephony and high speed data access on a broadband access network. The NIU includes a cable modem and a broadband telephone interface (BTI) coupled to the cable modem, the BTI providing access to lifeline services when the broadband access network is not accessible.

The present invention provides for a process for making a system for telephony and high speed data access on a broadband access network. The process includes the steps of coupling at least one telephone with a broadband telephone interface (BTI), coupling a backup telephone connection with the BTI, coupling the BTI with a cable modem, coupling the cable modem with the broadband access network, coupling the cable modem with at least one computer.

The present invention also provides for a method for making telephone calls in a system for telephony and high speed data access on a broadband access network when the broadband access network is inaccessible. The method includes the step of automatically coupling a telephone interface of a broadband telephone interface (BTI) to a backup telephone connection. In some preferred embodiments, the step of automatically coupling includes the step of automatically coupling the telephone interface of the BTI to a local exchange carrier (LEC) line. In other preferred embodiments, the step of automatically coupling includes the step of automatically coupling the telephone interface of the BTI to a wireless communication system. In yet other preferred embodiments, the step of automatically coupling includes the step of automatically coupling the telephone interface of the BTI to a cellular phone system.

The present invention provides for a method of making a telephone call by a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network. The method includes the steps of initiating a connection

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over an asynchronous transfer mode (ATM) backbone to a destination address, negotiating with the destination address with regard to capabilities, and completing a talking path between the BTI and the destination address.

The present invention provides for a method of sending a voice signal through a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network. The method includes the steps of sampling the voice signal at a telephone port of the BTI, performing speech compression on the sampled signal, performing packetization on the speech compressed signal, and placing the signal packets on the broadband access network.

The present invention also provides for a method of receiving a voice signal by a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network. The method includes the steps of receiving packets from the broadband access network, performing jitter compensation on the received packets, performing decompression on the jitter compensated packets, and playing the decompressed packets.

Brief Description of the Drawings

Figure 1 illustrates a system which provides telephony and high speed data access on a broadband access network.

Figure 2 illustrates an office in a system which provides telephony and high speed data access on a cable system.

Figure 3 illustrates a preferred embodiment with an internal relay.

Figure 4 illustrates another preferred embodiment with an external relay.

Detailed Description

Figure 1 illustrates a system which provides telephony and high speed data access on a broadband access network in accordance with a preferred embodiment of the present invention. The system 100 comprises offices 104, network interface units (NIUs) 108, personal computers 112, telephones 116, a broadband access network 120, an intermediate point-of-presence (IPOP) 124, an access network termination system (ANTS) 128, a switch 132, at least one number translation database 136, at least one external access network 140 and a local exchange carrier (LEC) line 148.

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Each office 104 comprises the NIU 108, the personal computer 112 and the telephone 116. The personal computer 112 is coupled to the NIU 108, the coupling being preferably through a local area network (LAN) such as, for example, an ethernet. As such, there may be a plurality of personal computers 112 coupled to the NIU 108. The telephone 116 is also coupled to the NIU 108. There may be more than one telephone 116 within the office 104 coupled to the NIU 108 either directly or indirectly. Furthermore, the telephone 116 may include any variety of office equipment such as fax machines, voice-grade modems, hand sets and internal housing wiring.

Each office 104 is coupled to the broadband access network 120 through its NIU 108. The broadband access network 120 is coupled to the IPOP 124. The broadband access network 120 in the system 100 is intended to accommodate a range of transport technologies such as, but not limited to, coaxial cable, hybrid-fiber coaxial cable, mini-fiber node and wireless technologies.

The IPOP 124 comprises the ANTS 128, the switch 132 and the at least one number translation database 136. The ANTS 128 is coupled to the switch 132 which, in turn, is coupled to the at least one number translation database 136. The ANTS 128 is coupled to the broadband access network 120. In a preferred embodiment, the at least one external access network 140 is coupled either to the ANTS 128 and/or to the switch 132. In a preferred embodiment, the at least one external access network 140 comprises a packet backbone 141 coupled to the ANTS 128. In another preferred embodiment, the at least one external access network 140 comprises an asynchronous transfer mode (ATM) backbone (not shown) coupled to the ANTS 128. In another preferred embodiment, the at least one external access network 140 comprises a long distance carrier network 142 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an LEC network 145 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an incumbent local exchange carrier (ILEC) network 144 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises an inter-exchange carrier (IXC) network 143 coupled to the switch 132. In another preferred embodiment, the at least one external access network 140 comprises the ATM backbone

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(not shown) coupled to the switch 132. The present invention contemplates any permutations and combinations of the above possible external access networks 140 and possible couplings to the IPOP 124.

In a preferred embodiment, the LEC line 148 couples the NIU 108 with the LEC network 145.

The general use and operation of the system 100 will now be described with reference to Figure 1. A user accesses the broadband access network 120 by using existing personal computers 112 or telephones 116 in the office 104. The voice and/or high speed data traffic transferred or received by these devices 112 and 116 passes through the NIU 108. The NIU 108 terminates the data-link layer protocol from the broadband access network 120 and provides services for voice, high speed data and any combination thereof. High speed data and telephony services share allocated bandwidth in the downstream direction as well as in the frequency agile upstream channel.

A remote data-link layer termination is performed at the IPOP 124 by the ANTS 128. Voice and high speed data traffic flowing to and from the offices 104 pass through the ANTS 128. Upstream voice and high speed data traffic are separated or groomed by the ANTS 128, if necessary, before being forwarded onwards. In a preferred embodiment, upstream voice traffic may be processed within the ANTS 128 which connects the voice to a circuit switched public switched telephone network (PSTN). Upstream data may be processed within the ANTS 128 before being handed to a router. In another preferred embodiment, upstream voice traffic is separated and routed to, for example, the packet backbone 141. Voice traffic is separated and routed to, for example, the local exchange switch 132. In another preferred embodiment, the ANTS 128 interfaces to the local switch 132 like, for example, a conventional subscriber loop carrier (SLC) system.

The system 100 acts, in part, as an LEC, providing voice service over the broadband access network 120. Calls originating from office 104 may be routed to, for example, the long distance network 142, the IXC network 143, the ILEC network 144 or the LEC network 145. Incoming long distance calls are routed to, for example, the LEC that serves the local number using the local number portability database. Several number translation databases 136 are typically needed in order to manage call routing.

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If communication to the IPOP 124 over the broadband access network 120 is not possible, lifeline services are provided, for example, through an LEC line 148 connected to the NIU 108. Thus, emergency phone calls can be made through the NIU 108 and the LEC line 148. If necessary, in one preferred embodiment, a call forwarding function in the local exchange switch 132 forwards telephone calls through the LEC line 148 to the telephone 116.

Figure 2 illustrates an office in a system which provides telephony and high speed data access on a cable system in accordance with another preferred embodiment of the present invention. The office 104 houses the NIU 108, the personal computer 112, the telephone 116, a local area network (LAN) 212 and a television 216. The NIU 108 further comprises a broadband telephone interface (BTI) 204 coupled to a cable modem 208. The BTI 204 may be integrated into the cable modem 208, a digital set-top box (not shown), or may be a standalone. For example, the BTI 204 may be a daughter card attached to a backplane bus within the cable modem 208 or set-top box.

The office 104 is coupled to the LEC line 148 and the broadband access network 120, which is illustrated in this preferred embodiment as a cable network. The LEC line 148 is coupled to the BTI 204 which is coupled to the telephone 116. The telephone 116 may comprise a plurality of telephones in an internal telephone network and may further include legacy equipment such as, but not limited to, fax machines, voice-grade modems, hand sets and internal housing wiring. The BTI 204 may have a plurality of telephony interfaces such as, for example, standard RJ-11 jacks to support a plurality of lines of telephony service. Accordingly, the BTI 204 may support a plurality of telephone numbers and addresses. The BTI 204 is expected to provide at least substantially the same interface as existing user interfaces to the PSTN.

The cable network 120 is coupled to the cable modem 208 or alternatively, the digital set-top box. The cable modem 208 is coupled to the LAN 212 which is coupled to the personal computer 112. The LAN 212 may be an ethernet, for example, and the personal computer 112 may be a plurality of personal computers coupled to the ethernet. The cable modem 208 is coupled to the LAN 212 through a data interface such as, for example, a 10 Mbs ethernet interface. Such an interface may be viewed as a termination in

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an office-area local network, with the cable modem 208 acting, in part, as a bridge. The cable 120 may also be coupled directly to the television 216 or may be coupled to the television 216 through a cable modem or digital set-top box.

In operation and use, the personal computers 112 through the ethernet 212 access high speed data ports in the cable modem 208. Through the cable modem 208, the ethernet 212 accesses, for example, internet services on the cable network 120. The television 216 accesses voice, high speed data and combinations thereof directly from the cable network 120, or alternatively from the cable modem 208 or the digital set-top box.

In a preferred embodiment, the BTI 204 supports a plurality of functions and services. The BTI 204 may provide, for example, at least one of the following: voice packetization, voice compression, the signaling and controlling of telephone calls, custom and basic service features, switching to backup service when the cable network 120 is down, and maintenance and provisioning.

For example, in a preferred embodiment, the BTI 204 provides custom telephony services including, but not limited to, caller identification, call waiting, tone block, return call, repeat call, call block, call forwarding, call forwarding on busy, call forwarding when no answer, anonymous call rejection, identa-ring, priority call, three-way calling and area code blocking. Furthermore, through the BTI 204, a wide ranging list of destinations may be dialed including, but not limited to, local calls, directory assistance, emergency calls, recorded announcements, domestic long distance calls, carrier-selected long distance calls, toll-free calls, operator services, international calls, so-called 500/700/900 calls, and Centrex dialing. In addition, the BTI 204 supports incoming calls over the cable network 120.

For the telephone ports, in the upstream direction, the BTI 204 samples the signal, performs speech compression, and performs packetization. The cable modem 208 places the packets on the cable network 120. In the downstream direction, the BTI 204 receives packets from the cable network 120 through the cable modem 208, performs jitter compensation in a playout buffer, performs decompression and plays out the samples.

In a preferred embodiment, the BTI 204 is used with existing cable modems 208, or alternatively, existing set-top boxes. The BTI 204 is also responsible for dual tone

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multi-frequency (DTMF) generation and detection, ringing voltage generation and off-hook detection. The standard RJ-11 jacks of the BTI 204 provide interfaces to legacy equipment in the office, such as, but not limited to, telephones including analog devices, fax machines and voice-band modems with speeds up to at least 56 kbps.

The aforementioned architecture and approach offer compelling economic advantages. By leveraging cable modem solutions for high-speed data access into the realm of telephony, equipment such as cable modems 208 or set-top boxes facilitate multiple services. Accordingly, channels dedicated previously only to data service may also derive revenue from telephony. Furthermore, in order for cable telephone to be used as a primary local telephone service, the present invention must support lifeline services even when the cable network 120 is down.

The BTI 204 supports a dynamic fail-safe switch to, for example, the LEC backup line 148. Transmission on the cable network 120 requires power. Therefore, absent a backup power source for the cable network, e.g., an alternatively powered cable system, which is also contemplated by the present invention, an alternative to the cable network is required. In a preferred embodiment, during power outages, the LEC line 148 is used to complete inbound and outbound telephone calls. The transition from the cable network 120 to the LEC line 148 is performed automatically and transparently with almost imperceptible performance differences. In some preferred embodiments, calls in progress at the time of a power loss are dropped, and the user must redial. In other preferred embodiments, custom calling features are not available during power outages. In another preferred embodiment, the BTI 204 provides, for example, all PSTN features and functions, except during the fail-safe mode. In the fail-safe mode of another preferred embodiment, the LEC backup line 148, for example, provides basic plain old telephone service (POTS).

Figures 3 and 4 illustrate two embodiments of the present invention that also support lifeline services. In Figures 3 and 4, much of the structure has been previously described above; in addition, a relay 304 or 308 is coupled to the BTI 204. Figure 3 illustrates one embodiment including the internal relay 304 which may be integrated with the BTI 204. Figure 4 illustrates another embodiment including the external relay 308. In

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either embodiment, the relay 304 or 308 is managed by the BTI 204. The relay 304 or 308 switches or bridges one or more of the telephones 116, interfaced with the BTI 204, to the LEC backup line 148 when, for example, a power outage has occurred or the cable network 120 is unavailable. In another preferred embodiment, the BTI 204 supports lifeline services by switching to a backup cellular phone service (not shown) instead of the LEC line 148.

In one preferred embodiment, the relay 304 or 308 is, for example, a double-pole, double-throw spring-loaded relay. Normally-closed contacts are coupled to the LEC backup line 148; normally-opened contacts are coupled to the BTI 204; center contacts are coupled to tip and ring signals of the telephone 116. In another preferred embodiment, the backup cellular phone service is adapted to couple with the double-pole, double-throw spring-loaded relay.

In a preferred embodiment, the BTI 204 provides non-volatile storage, for example, EEPROM, so as to allow the maintenance of some amount of state at the BTI 204. Such an architecture and approach facilitate the migration of many telephony features into the BTI 204. With the further installation of intelligence such as, for example, processing and memory into the BTI 204, unique opportunities arise pertaining to reinventing network operations with a very high level of automation, a corresponding reduction in operating costs and a significant increase in overall service quality. Such architectures and approaches accommodate future networks by, for example, providing compatibility with the ATM backbone as well as adaptability to any new features and functions that may arise. In a preferred embodiment, for example, with the migration of feature support into the BTI 204, ATM telephony is routed directly to an edge vehicle on a backbone network; internet protocol (IP) telephony along with other data traffic is sent to a router/switch edge vehicle on the backbone network or is directly routed onto the internet.

In a preferred embodiment, the BTI 204, with special feature support, accesses the ATM backbone network directly. The BTI 204 performs digit collection, as well as many call handling features as described above including, but not limited to, call waiting, call forwarding and last number redial. The BTI 204 initiates a connection over the ATM backbone to the destination address, negotiates with that endpoint regarding capabilities

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such as, but not limited to, coding, encapsulation, silence suppression, and finally completes the talking path. The BTI 204 uses the quality of service features of the ATM network to provide toll-quality telephony.

In a preferred embodiment, the BTI 204 may have certain requirements in order to provide voice quality that is as close to wireline voice quality as possible. For example, in order to minimize echo, the BTI 204 should provide echo cancellation of a minimum of 70 dB. In another preferred embodiment, the access delay, the round-trip time measured from a mouthpiece of a hand set of the telephone 116 to the access point of a long distance network and back, should be less than 20 ms. In another preferred embodiment, the BTI 204 may support silence suppression and speech enhancement. In another preferred embodiment, an 8kHz national clock which controls the sampling frequency and regeneration frequency should be used by the BTI 204 to encode speech signals.

In a preferred embodiment, in order to support legacy voiceband data equipment, such as, but not limited to, fax machines and telephone bandwidth modems, the BTI 204 should support 64 kb/s G.711 mu-law PCM as one choice of coders. In another preferred embodiment, the BTI 204 may also support G.728 or G.723.1 as choices of coders. In another preferred embodiment, since echo cancellation tends to cause troubles for the above mentioned legacy equipment, the BTI 204 should be able to recognize a fax or modem control tone and disable echo cancellation during these calls.

In a preferred embodiment in which voice connections are transported over an ATM fabric, the BTI 204 should be capable of sending packets that will be transferred to the ATM fabric as signaling packets. In another preferred embodiment, the BTI 204 should be able to transport packets destined to ATM interface as either available-bit-rate (ABR) or constant-bit-rate (CBR) connections. In another preferred embodiment, the BTI 204 should be able to identify packets destined for the IP router or the SLC and connect as either ABR or CBR connections.

Although the foregoing invention has been described in terms of certain embodiments, other embodiments will become apparent to those of ordinary skill in the art in view of the disclosure herein. Accordingly, the present invention is not intended to be

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limited by the recitation of embodiments, but is intended to be defined solely by reference to the appended claims.

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WHAT IS CLAIMED IS:

1. A broadband telephone interface (BTI) for use in a system for telephony and high speed data access on a cable network, comprising:

a first interface coupled to a backup telephone service;

a second interface coupled to at least one telephone;

a third interface coupled to a cable modem, the cable modem being coupled to the cable network; and

a relay, wherein during availability of the cable network the second interface is coupled to the third interface and wherein during unavailability of the cable network, the relay couples the first interface to the second interface.

2. The broadband telephone interface (BTI) of Claim 1, wherein the backup telephone service is a backup local exchange carrier (LEC) line.

3. The broadband telephone interface (BTI) of Claim 1, wherein the backup telephone service is a cellular phone service.

4. The broadband telephone interface (BTI) of Claim 1, wherein the second interface is at least one standard RJ-11 jack.

5. The broadband telephone interface (BTI) of Claim 1, wherein the at least one telephone comprises any of fax machines, modems, internal housing wiring, hand sets, analog telephones and digital telephones.

6. The broadband telephone interface (BTI) of Claim 1, wherein the BTI and the cable modem are integrated.

7. The broadband telephone interface (BTI) of Claim 1, wherein the cable modem includes a set-top box.

8. The broadband telephone interface (BTI) of Claim 1, further comprising:

non-volatile storage;

a processor coupled to the non-volatile storage; and

a memory coupled to the processor, wherein the interfaces and the relay are controlled by the processor.

9. A network interface unit (NIU) for a system for telephony and high speed data access on a broadband access network, comprising:

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a cable modem; and

a broadband telephone interface (BTI) coupled to the cable modem, the BTI providing access to a telephone line when the broadband access network is not accessible.

10. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) provides any of the services from the group consisting of voice packetization, signaling and controlling of telephone calls, custom and basic service features, and maintenance and provisioning.

11. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) provides any custom service selected from the group consisting of caller identification, call waiting, tone block, return call, repeat call, call block, call forwarding, call forwarding on busy, call forwarding when no answer, anonymous call rejection, identa-ring, priority call, three-way calling, and area code blocking.

12. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) provides through the cable modem a calling destination selected from the group consisting of local calls, directory assistance, emergency calls, recorded announcements, domestic long distance calls, carrier-selected long distance calls, toll-free calls, operator services, international calls, 500/700/900 calls, and Centrex dialing.

13. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) supports incoming calls over the cable modem.

14. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) provides any of dual tone multi-frequency (DTMF) generation and detection, ringing voltage generation and off-hook detection.

15. The network interface unit (NIU) of Claim 9, wherein the broadband telephone interface (BTI) accesses an asynchronous transfer mode (ATM) backbone network directly.

16. A process for making a system for telephony and high speed data access on a broadband access network, comprising the steps of:

coupling at least one telephone with a broadband telephone interface (BTI);

coupling a backup telephone connection with the BTI;

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coupling the BTI with a cable modem;

coupling the cable modem with the broadband access network; and

coupling the cable modem with at least one computer.

17. A method for making telephone calls in a system for telephony and high speed data access on a broadband access network when the broadband access network is inaccessible, comprising the step of automatically coupling a telephone interface of a broadband telephone interface (BTI) to a backup telephone connection.

18. The method of Claim 17, wherein the step of automatically coupling comprises the step of automatically coupling the telephone interface of the BTI to a local exchange carrier (LEC) line.

19. The method of Claim 17, wherein the step of automatically coupling comprises the step of automatically coupling the telephone interface of the BTI to a wireless communication system.

20. The method of Claim 17, wherein the step of automatically coupling comprises the step of automatically coupling the telephone interface of the BTI to a cellular phone system.

21. A method of making a telephone call by a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network, comprising the steps of:

initiating a connection over an asynchronous transfer mode (ATM) backbone to a destination address;

negotiating with the destination address with regard to capabilities; and

completing a talking path between the BTI and the destination address.

22. A method of sending a voice signal through a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network, comprising the steps of:

sampling the voice signal at a telephone port of the BTI;

performing speech compression on the sampled signal;

performing packetization on the speech compressed signal; and

placing the signal packets on the broadband access network.

ENSDOCID: <WO 9939541A2 IA>

23. A method of receiving a voice signal by a broadband telephone interface (BTI) in a system for telephony and high speed data access on a broadband access network, comprising the steps of:

receiving packets from the broadband access network;

performing jitter compensation on the received packets;

performing decompression on the jitter compensated packets; and

playing the decompressed packets.

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FIG. 1

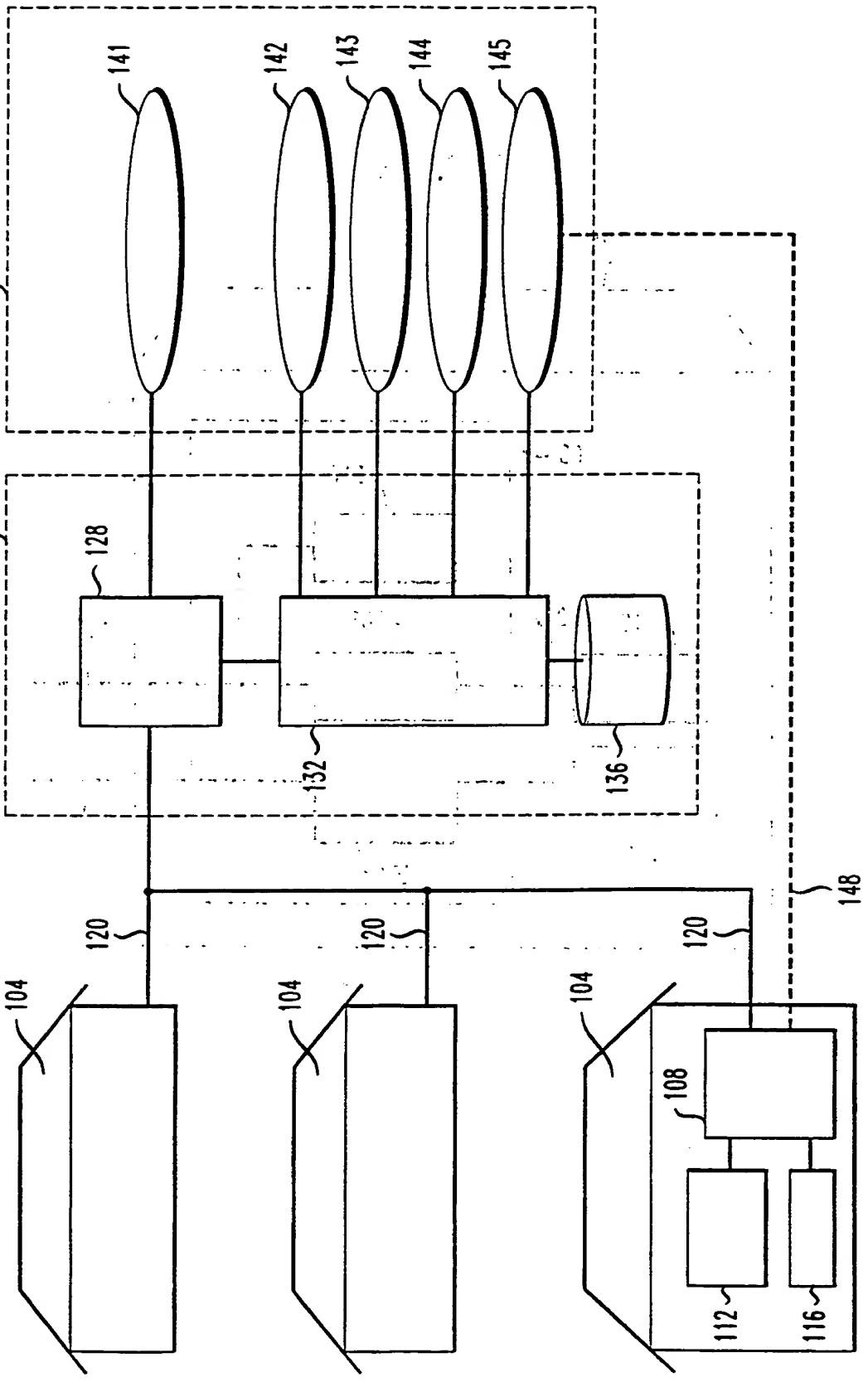

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FIG. 2

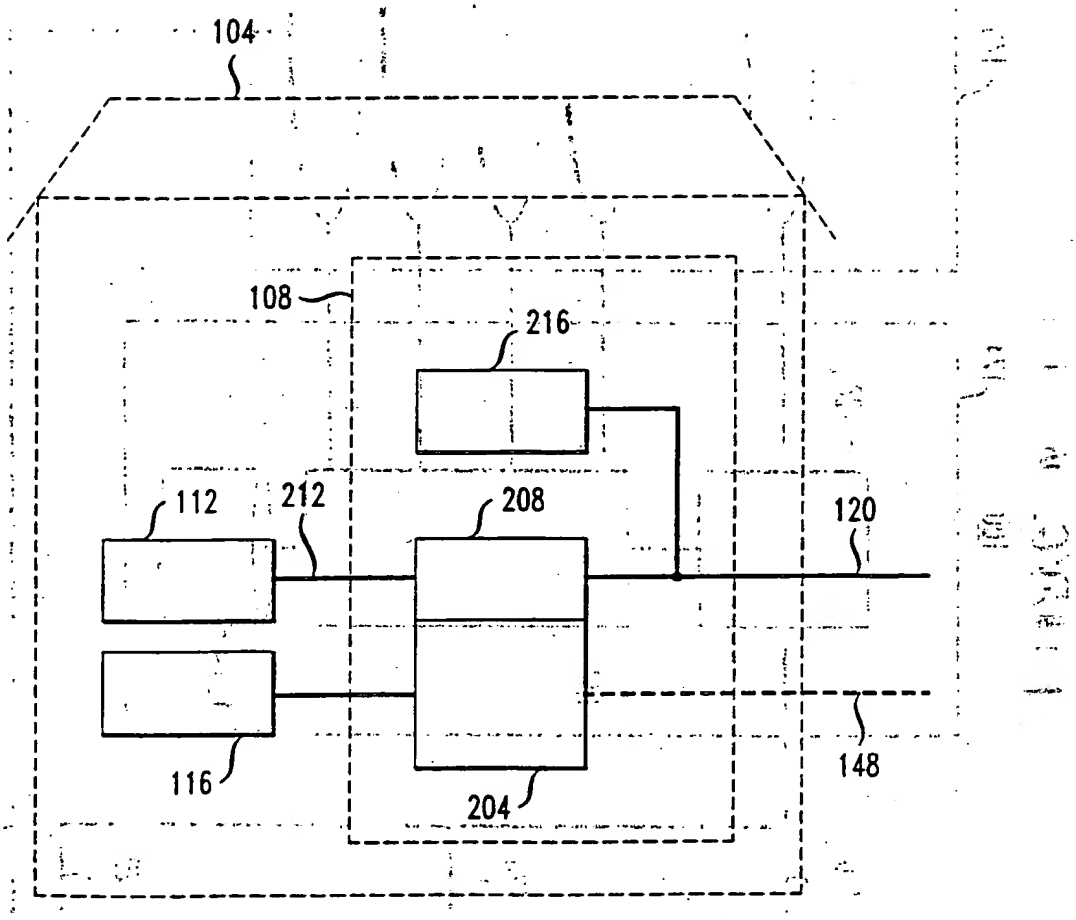

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FIG. 3

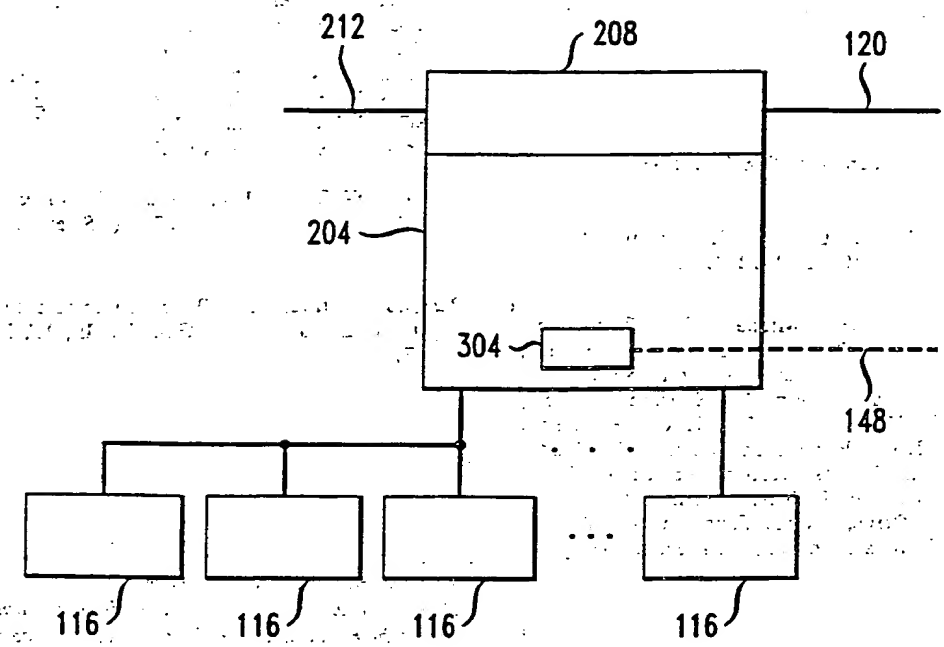
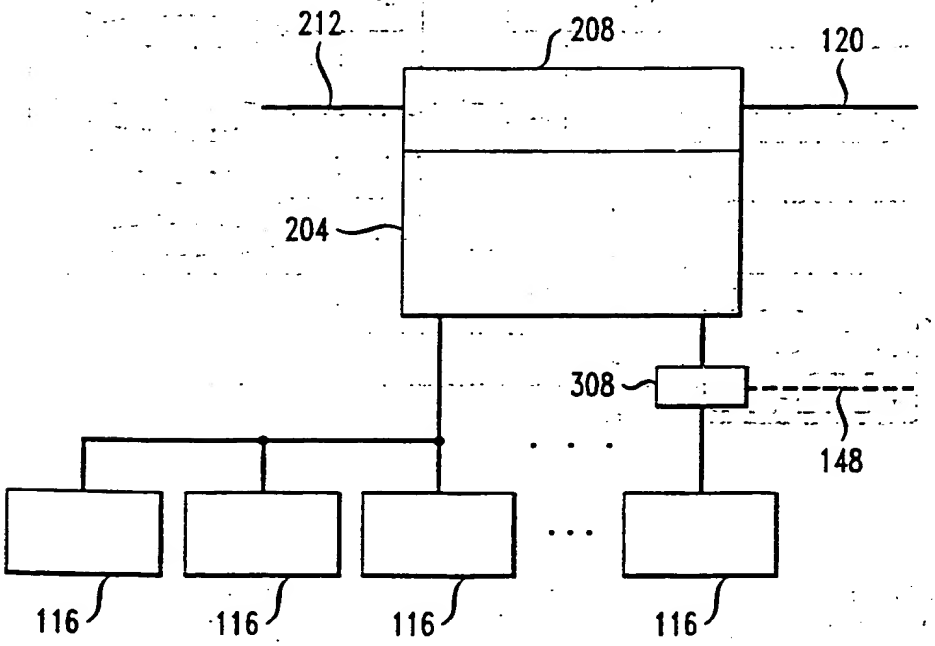


FIG. 4



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CORRECTED VERSION*

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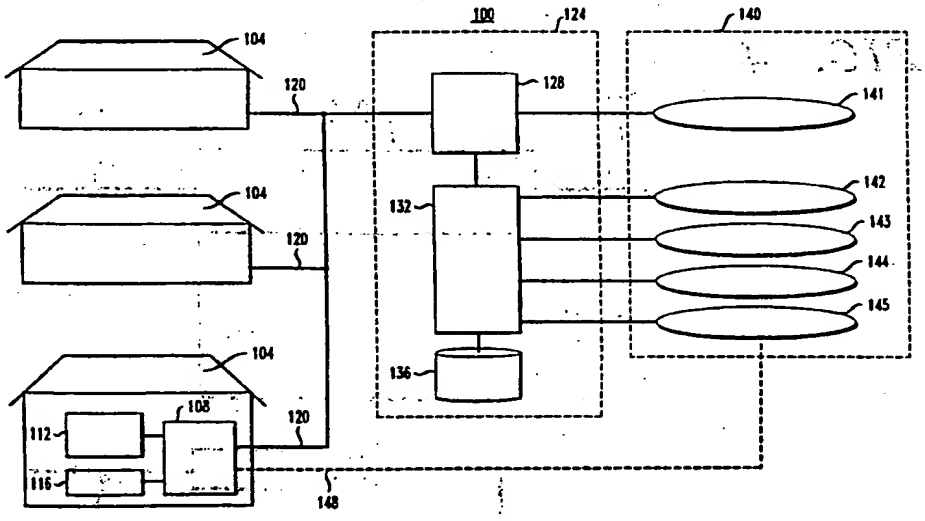

(57) Abstract

A system and method for providing telephony and high speed data access on a broadband access network, comprising a network interface unit (NIU) coupled to a backup local exchange carrier (LEC) line, the broadband access network coupled to the NIU, an intermediate point-of-presence (IPOP) coupled to the broadband access network, and at least one external access network coupled to the IPOP. The NIU comprises a broadband telephone interface (BTI) which is coupled to at least one telephone. When the broadband access network is unavailable, the BTI switches the at least one telephone to the backup LEC line.

*(Referred to in PCT Gazette No. 42/1999, Section II)

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3NSDOCID: <WO___9939541A3 I >

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/01840

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L12/28 H04L29/06 H04Q11/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L H04Q H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HERNANDEZ-VALENCIA E J: "ARCHITECTURES FOR BROADBAND RESIDENTIAL IP SERVICES OVER CATV NETWORKS" IEEE NETWORK: THE MAGAZINE OF COMPUTER COMMUNICATIONS, vol. 11, no. 1, 1 January 1997, pages 36-43, XP000679054	9,16
A	see page 36, left-hand column, line 1 - page 41, right-hand column, line 19	1,2,4,6, 17,18

A	IRIE K ET AL: "LOW-END CARD FOR REGIONAL PC COMMUNICATION NETWORK" ELECTRONICS & COMMUNICATIONS IN JAPAN, PART I - COMMUNICATIONS, vol. 80, no. 10, 1 October 1997, pages 20-27, XP000724512 especially fig. 1 see the whole document	1,5,8,9, 16,17

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 June 1999	25.10.99

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Karavassilis, N

Form PCT/ISA/210 (second sheet) (July 1992)

BNSDOCID: <WO___9939541A3_I_>

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/01840

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 719 062 A (AT & T CORP) 26 June 1996 see page 2, column 1, line 39 - column 2, line 3; figure 1	3,19,20

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

BNSDOCID: <WO___9939541A3_1_>

INTERNATIONAL SEARCH REPORT

Int. ..tional application No.
PCT/US 99/01840

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-9,16-20

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

BNSDOCID: <WO___9939541A3_I_>

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

1. Claims: 1-9, 16-20

BROADBAND TELEPHONE INTERFACE AND METHOD FOR AUTOMATICALLY COUPLING A BACKUP TELEPHONE LINE

2. Claims: 10-15 (as dependent on claim 9)

NETWORK INTERFACE FOR PROVIDING CUSTOM SERVICES OVER A CABLE NETWORK

3. Claim : 21

METHOD FOR CONNECTION SET-UP OVER ATM

4. Claims: 22,23

METHOD FOR TRANSMITTING AND RECEIVING PACKETISED VOICE SIGNAL

3NSDOCID: <WO___9939541A3_I_>

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/01840

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0719062 A	26-06-1996	US 5592470 A	07-01-1997
		JP 8280058 A	22-10-1996

BNSDOCID: <WO___9939541A3_I_>

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